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Screening for coronavirus disease 2019 in pregnant women admitted for delivery: an observational study

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SUMMARY

OBJECTIVE: The aim of this study was to examine the impact of symptom-based screening on the prevalence and outcomes of neonatal coronavirus disease 2019 in pregnant women admitted for delivery.

METHODS: A retrospective observational study was conducted from June to August 2020 at Gonzaga Mota of Messejana Hospital, Fortaleza, CE, Brazil. All pregnant women were screened for coronavirus disease 2019 based on symptoms. Reverse transcription-polymerase chain reaction or immunology assays for severe acute respiratory syndrome coronavirus 2 were performed when a patient reported a symptom. All newborns of symptomatic patients were submitted for Reverse transcription-polymerase chain reaction. Newborns were divided into groups according to the Reverse transcription-polymerase chain reaction results to identify the relationship between maternal symptoms and neonatal coronavirus disease 2019.

RESULTS: A total of 55 (55/1,026, 5.4%) and 50 (50/1,026, 4.8%) pregnant women reported symptoms and had a positive confirmatory test, respectively. The most common symptom of coronavirus disease 2019 among the pregnant women with positive confirmatory test was cough (n=23, 46%). Seven newborns (7/50, 14%) of symptomatic mothers had positive Reverse transcription-polymerase chain reaction. Upon birth, no newborn had serious complications.

CONCLUSION: Universal screening of pregnant women admitted for delivery can reduce the perinatal transmission of coronavirus disease 2019. Symptom-based screening can be an alternative for regions with a low prevalence of the disease where a better allocation of financial resources is necessary.

KEYWORDS: COVID-19. Obstetric delivery. Newborn. Perinatal care. SARS-CoV-2. Infectious disease transmission.

INTRODUCTION

The first case of a severe acute respiratory syndrome caused by a new coronavirus, later called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was identified in December 2019 in Wuhan, Hubei Province, China. Coronavirus disease 2019 (COVID-19) has spread rapidly across the world, prompting the World Health Organization (WHO) to declare a pandemic status on March 11, 2020[1,2]. At the end of January 2021, COVID-19 infected more than 98 million people and was responsible for more than 2.1 million deaths worldwide[3].

Clinically, COVID-19 has a wide range of disease manifestations that have been identified in five different cases: asymptomatic (1.2%), mild to moderate (80.9%), severe (13.8%), critical (4.7%), and mortality (2.3%). Young adults of reproductive age are the most affected, but the highest mortality occurs in the elderly population and those with comorbidities such as obesity, hypertension, diabetes, and other chronic diseases[4]. The number of COVID-19 cases among pregnant women is still uncertain. Studies performed with pregnant women at the time of delivery revealed that the prevalence of COVID-19 ranged from 0.43 to 19.8%[5-10]. This large variation in the prevalence of SARS-CoV-2 infection at the time of delivery depends on the area studied, type of screening performed, number of tests performed, period studied, and gestational risk[11].

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The impact of COVID-19 on pregnant women is still poorly understood. Initially, based on the respiratory physiology of a pregnant woman, maternal immune response during pregnancy, and experience of other severe acute respiratory syndromes, it was believed that SARS-CoV-2 infection in the perigestational period could lead to more serious cases[12]. Current evidence indicates that the morbidity and mortality of COVID-19 among pregnant women are similar to those of non-pregnant women. However, some authors have identified high mortality among pregnant women with COVID-19, suggesting that factors such as a higher prevalence of comorbidities, ethnic differences, and poor quality of obstetric care may contribute to a more severe development of the disease[13-15].

The risk of neonatal COVID-19 is due to possible vertical transmission, maternal transmission after delivery, or even transmission from the health team involved in the care of the mother-child binomial. Current knowledge about neonatal COVID-19 is still limited to a small number of cases, which indicate a favorable clinical course with few symptoms and low morbidity and mortality. However, identification of pregnant women infected with SARS-CoV-2 at the time of delivery is important in order to enforce safety and isolation measures[16].

The goal of this study was to evaluate the impact of a symptom-based screening protocol on the prevalence and outcomes of neonatal COVID-19.

METHODS

This was a retrospective observational study conducted from June 2020 to August 2020 at Gonzaga Mota of Messejana Hospital, Fortaleza, CE, Brazil. The inclusion criterion was admission for delivery during the study period. Exclusion criteria were loss of follow-up and non-agreement to participate in the study. During this period, all pregnant women admitted for delivery were screened for COVID-19 clinical symptoms such as cough, dyspnea, abnormalities in smell and taste, hyporexia, fever, diarrhea, and headache at any time during pregnancy. Pregnant women with a history or occurrence of any symptoms were immediately isolated and referred for laboratory investigation at the time of childbirth. A single swab collection from the posterior oropharynx and nasopharynx was performed when the pregnant woman was between the 3rd and 10th days after the onset of symptoms, and then a reverse transcriptase polymerase chain reaction (RT-PCR) assay was conducted for SARS-CoV-2 (Bio-Manguinhos, Rio de Janeiro, RJ, Brazil; Instituto de Biologia Molecular do Paraná, Curitiba, PR, Brazil; Mobius Life Science, Pinhais, PR, Brazil). On the contrary, the immunology assay (rapid test) was performed from the 7th day after the onset of symptoms (Wondfo One Step COVID-19 rapid test kits, Guangzhou, China).

In all newborns of symptomatic pregnant women, clinical conditions at birth were assessed, and, if possible, prompt clamping of the umbilical cord within 1 min of life was suggested, while skin-to-skin contact was not indicated. The nasopharyngeal swab to perform RT-PCR was conducted in children after initial care at birth or up to 48 h of life[17]. Bathing a newborn was done if birth was by vaginal delivery. After birth, asymptomatic newborns of symptomatic pregnant women with favorable maternal conditions stayed isolated with the mother in the rooming-in until hospital discharge, with maternal hygiene care guidelines and by wearing a mask and maintaining 2 m between the binomials. If the newborns had symptoms (fever, cough, difficulty in breathing and/or tachypnea, hypoactivity, and food refusal), they were referred to the neonatal unit in intensive or intermediate care and remained in isolation until symptoms had been resolved and the mothers could be accommodated in room[18].

Newborns of symptomatic pregnant women were divided into two groups based on the result of the RT-PCR after birth (RT-PCR SARS-CoV-2 positive and RT-PCR SARS-CoV-2 negative) to identify the possible relationship between any maternal symptom and a positive neonatal COVID-19.

Data were analyzed using IBM SPSS Statistics for Windows, version 25.0 (Armonk, NY: IBM Corp.). In addition, descriptive statistics were performed on symptomatic pregnant women. The mean (± standard deviation) and median (interquartile ranges) were used for continuous variables. Differences in the distribution of maternal and neonatal characteristics were assessed using the chi-square or Fisher's exact tests for categorical variables and the Mann-Whitney U test for continuous variables. p=0.05 was found to be statistically significant. The study was approved by the Ethic Committee of the University of Fortaleza (CAAE number 34594620.9.0000.5052/approval number 4.147.638) and conducted within ethical principles and rules, with a free and informed consent form signed by all participants.

RESULTS

During the time of the study (June to August 2020), 1,026 pregnant women were admitted for delivery. A total of 55 (55/1,026, 5.4%) pregnant women reported a history or presence of symptoms related to COVID-19. On the contrary, 50 (50/1,026, 4.8%) pregnant women had a positive confirmatory test (Figure 1). The median age of these symptomatic pregnant women was 23 years (interquartile range [IQR]: 20 to 28.2

years). The most common symptom of COVID-19 among the 50 pregnant women with positive confirmatory tests was cough (n=23, 46%), followed by coryza (n=16, 32%), ageusia (n=16, 32%), anosmia (n=15, 30%), headache (n=12, 24%), fever (n=11, 22%), sore throat (n=11, 22%), myalgia (n=9, 18%), nasal obstruction (n=8, 16%), diarrhea (n=8, 16%), fatigue (n=5, 10%), dyspnea (n=4, 8%), and adynamia (n=2, 4%) (Table 1).

Of the total symptomatic pregnant women submitted to the laboratory, 31 tested positive for COVID-19 (31/50, 62%) (Figure 1). Based on the interval between the onset of symptoms and admission for delivery, 26 patients were investigated using RT-PCR, with 5 positive tests (5/26, 19.2%), and 40 patients underwent immunological testing, with 28 positive cases (28/40, 70%). Moreover, 7 of the 50 newborns from symptomatic mothers had a positive RT-PCR for SARS-CoV-2, and 6 swabs were obtained immediately at birth and 1 after 36 h of life. Five were neonates of mothers with positive COVID-19 laboratory tests (two positive RT-PCR and three positive immunologic tests), and two were neonates of pregnant women with negative COVID-19 laboratory tests (one negative RT-PCR and one negative RT-PCR and immunological test) (Figure 1 and Table 2).

The overall median birth weight was 3,290 g (IQR: 3,037–3,650 g) and the median APGAR score at the 1st and 5th min was 8 (IRQ: 8–9) and 9 (IRQ: 9–9), respectively. There was no substantial difference between maternal and neonatal variables compared to groups of positive and negative newborns for SARS-CoV-2 RT-PCR (Table 1). Upon birth, no newborn had serious complications. One newborn had mild respiratory distress, while another (male) had mild respiratory distress associated with fever at 36 h of life, and bilateral hydronephrosis was diagnosed and transferred to a tertiary hospital during the investigation (Table 2).

Table 1. Characteristics of pregnant women with symptoms for coronavirus disease 2019 and their newborns.

Variables	RT-PCR SARS-CoV-2 positive (n=7)	RT-PCR SARS-CoV-2 negative (n=43)	p
Maternal age, median (IQR 25;75)	20 (19–34)	23 (20–28)	0.661[a]
Gestational age, median (IQR 25;75)	39 (38–40)	39 (38–40)	0.410[a]
Gravidity, median (IQR 25;75)	2 (1–3)	2 (1–3)	0.848[a]
Parity, median (IQR 25;75)	2 (1–2)	2 (1–2)	0.913[a]
Miscarriages, median (IQR 25;75)	0 (0-0)	0 (0–1)	0.565[a]
Cough, n (%)	03 (42.9)	20 (46.5)	1.000[b]
Coryza	00 (00)	16 (37.2)	0.159[b]
Ageusia, n (%)	01 (14.3)	15 (34.9)	0.485[b]
Anosmia, n (%)	01 (14.3)	14 (32.6)	0.496[b]
Headache, n (%)	03 (42.9)	09 (20.9)	0.433[b]
Fever, n (%)	01 (14.3)	10 (23.3)	1.000[b]
Sore throat, n (%)	01 (14.3)	10 (23.3)	1.000[b]
Myalgia	00 (00)	09 (20.9)	0.417[b]
Nasal obstruction	00 (00)	08 (18.6)	0.640[b]
Diarrhea, n (%)	01 (14.3)	07 (16.3)	1.000[b]
Fatigue	01 (14.3)	04 (9.3)	0.616[b]
Dyspnea, n (%)	00 (00)	04 (9.3)	1.000[b]
Adynamia	01 (14.3)	01 (2.3)	0.370[b]
Pregnant COVID-19 test positive, n (%)	05 (71.4)	26 (60.4)	0.695[b]
Birth weight median (IQR25;75)	3,345 (3,250–3,555)	3,250 (3,010–3,655)	0.546[a]
APGAR score 1st minute (median, IQR)	8 (8–9)	9 (8–9)	0.870[a]
APGAR score 5th minute (median, IQR)	9 (9–9)	9 (9–9)	0.935[a]

Miscarriages: number of pregnancy losses before 20 weeks of gestation. Differences in the distribution of maternal and neonatal characteristics were assessed using the chi-square or Fisher's exact tests for categorical variables and Mann-Whitney U test for continuous variables; SD: standard deviation; IQR: interquartile range; p=0.05 was considered statistically significant. Note: [a]p=Mann-Whitney U test; [b]p=Fisher's exact test.

DISCUSSION

The effect of COVID-19 on pregnant women and newborns is still poorly understood. Apparently, vertical transmission is an unusual phenomenon. However, there is a risk of transmission during the neonatal period, particularly during breastfeeding and in the care of the newborn by healthcare professionals and family members. Some studies suggest that pregnant women should be universally screened at the time of admission for delivery. Some authors recommend screening based on symptoms or pregnancy risk[19,20].

The main findings of our study showed that at the beginning of the COVID-19 pandemic and in the face of financial and laboratory constraints, symptom-based screening of pregnant women admitted to a low-risk hospital for delivery was a decision that did not seem to worsen perinatal outcomes.

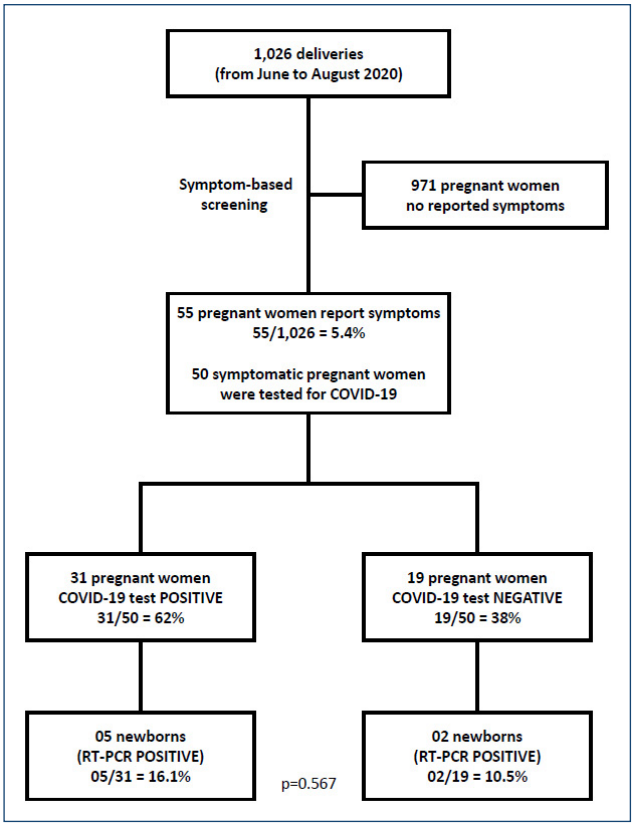

Figure 1. Patients' flowchart. From June to August 2020, 1,026 pregnant women were admitted for delivery. A total of 55 pregnant women reported a history or symptoms related to coronavirus disease 2019. Additionally, 50 pregnant women had a positive confirmatory test. Thirty-one pregnant women tested positive for coronavirus disease 2019. Moreover, 7/50 newborns from symptomatic mothers had a positive reverse transcriptase polymerase chain reaction for severe acute respiratory syndrome coronavirus 2. Five were neonates of mothers with positive coronavirus disease 2019 laboratory investigation, and two were neonates of pregnant women with negative coronavirus disease 2019 laboratory investigation. There was no significant difference between these groups in the prevalence of neonatal coronavirus disease 2019.

However, our study has several limitations. First, the lack of a control group that underwent universal screening did not allow comparison of perinatal outcomes with symptom-based screening. The other limitation was the lack of diagnostic criteria for perinatal SARS-CoV-2 transmission, which were not defined at the time of the pandemic.

At the beginning of December 2020, the countries with the highest number of confirmed cases of COVID-19 were the USA (15.4 million), India (9.7 million), and Brazil (6.6 million), with a total of 46,435, 7,022, and 31,099 cases, respectively, per million inhabitants[3]. The overall prevalence of symptomatic SARS-CoV-2 infection has remained uncertain. Oran et al.[21] estimated that about 55–60% of people infected with SARS-CoV-2 had any symptoms. However, the authors highlighted the inconsistency of the data in the literature, as the percentage of symptomatic patients in the studies ranged from 7 to 93.7%.

Universal screening showed that about one-third of pregnant women with COVID-19 were symptomatic when they were admitted for delivery. However, the proportion of pregnant women infected with SARS-CoV-2 with symptoms was highly variable. A study conducted in Chile between April and June 2020 found that 56.8% of pregnant women (37/583) with COVID-19 at delivery were symptomatic[5], while another four studies, carried out in three different countries [Japan, Spain, and the USA (Southern California and Brooklyn, New York, NY)] with fewer participants, found no symptomatic pregnant women with RT-PCR for SARS-CoV-2[10].

Also, the Centers for Disease Control and Prevention (CDC) described that the most commonly reported signs and symptoms were cough (50.3%), headache (42.7%), muscle aches (36.7%), and fever (32%) among pregnant women with COVID-19. In the review study by Amaral et al.[22], cough (44.4%) and nausea (10.2%) were the most frequent symptoms among pregnant women affected by COVID-19, while in the study by Elshafeey et al.[23], these symptoms were fever (67.3%) and cough (65.7%). In our study, we found that, in addition to cough and coryza, taste and smell abnormalities were often reported by pregnant women with COVID-19.

The rate of perinatal transmission at our institution was 16.1% (5/31), similar to that described by Biasucci et al.[6] (13.3%), and higher than that described by Corvillon et al.[5] (5.4%). Shah et al.[23] described a classification system and case description for SARS-CoV-2 infection in pregnant women, fetuses, and neonates. Based on the proposal by Shah et al.[23] 6/7 cases of COVID-19 in our observational study can be categorized as neonatal infection acquired intrapartum (detection of the virus by PCR in a nasopharyngeal swab at birth and

Table 2. Clinical and laboratory characteristics of newborns with reverse transcriptase polymerase chain reaction positive for coronavirus disease 2019.

Case #	Maternal age (years)	Gestational age (weeks)	Mode of delivery (reason)	Gender	Weight (g)	APGAR score (1–5 min)
1	35	38	C-section (gestational diabetes)	Female	3,555	8–9
2	24	42	Vaginal	Male	3,140	9–9
3	17	39	Vaginal	Female	3,390	8–9
4	20	37	C-section (breech presentation)	Male	3,325	9–9
5	19	42	C-section (postterm pregnancy)	Male	3,560	8–9
6	20	39	Vaginal	Male	3,345	8–9
7	34	40	C-section (previous C-section)	Male	3,250	9–9

RT-PCR: reverse transcriptase polymerase chain reaction; NA: not available; NS: no symptom; CRP: C-reactive protein; ALT: alanine aminotransferase; AST: aspartato aminotransferase; LDH: lactic acid dehydrogenase. Case #6: this newborn was transferred to tertiary hospital due to the diagnosis of bilateral hydronephrosis and urinary infection.

not at 24–48 h). Interestingly, there were two cases of perinatal COVID-19 in neonates of mothers who tested negative for SARS-CoV-2, which can be due to a mother's false-negative RT-PCR or neonatal transmission shortly after delivery.

Current data indicate an association between COVID-19 and a risk of preterm birth and low birth weight[14,15,22,24,25]. However, in our study, all newborns with perinatal COVID-19 were born at term and with adequate weight. This result is justified by the fact that our maternity care serves low-risk pregnancies. All neonates evolved without serious complications. Two newborns developed respiratory distress, which may be due to COVID-19 or adaptation of the fetal circulation to neonatal or newborn transient tachypnea, in addition to neonatal infection, as one of these children had a positive urine culture and was diagnosed with bilateral hydronephrosis.

CONCLUSION

Universal screening of pregnant women admitted for delivery is the best way to reduce the risk of perinatal transmission of COVID-19. At the beginning of the COVID-19 pandemic, still in a scenario without vaccination coverage and with financial and laboratory restrictions, as well as the low morbidity of COVID-19 in the neonatal period, it was necessary to carry out a selective screening. The observed results suggest that screening only symptomatic pregnant women at the time of admission for delivery in low-risk maternity was the correct alternative for regions with a low prevalence of the disease and where a better allocation of financial resources was needed.

AUTHORS' CONTRIBUTIONS

ANMC: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft. **RLFA**: Conceptualization, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing – review & editing. **DNO**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **DML**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **CTMBC**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **LVST**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **RPA**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **RPGM**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **EAJ**: Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing. **MBC**: Conceptualization, Formal Analysis, Investigation, Methodology, Visualization, Writing – review & editing.

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